

IN THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Previously Presented) A semiconductor device comprising:

an insulating film formed on a substrate provided with a transistor and having an opening portion;

a conductive film formed in the opening portion; and

a capacitor formed on the conductive film and comprising a first electrode, a ferroelectric film and a second electrode;

wherein the ferroelectric film includes at least one element selected from the group consisting of lead, barium and bismuth and formed from above the first electrode to above the insulating film;

wherein a reaction barrier film is provided between the insulating film and the ferroelectric film to prevent a reaction between the insulating film and the ferroelectric film, said reaction barrier film being in contact with a lower surface of said first electrode such that the reaction barrier film is interposed between the lower surface of the first electrode and said insulating film;

wherein a diffusion barrier film is provided between the conductive film and the first electrode and side faces of the diffusion barrier are not brought into contact with the ferroelectric film;

wherein an upper surface of said diffusion barrier film and an upper surface of said reaction barrier film are substantially on a same plane and thicknesses of said diffusion barrier film and said reaction barrier film are substantially the same; and

wherein side faces of the first electrode are provided to be brought into contact with the ferroelectric film.

2. (Original) The semiconductor device according to claim 1:

wherein the ferroelectric film comprises any of the group consisting of lead titanate zirconate, lead titanate, barium lead titanate zirconate, barium lead niobate, strontium bismuth tantalite, bismuth titanate and barium strontium titanate zirconate.

3. (Original) The semiconductor device according to claim 1:

wherein the reaction barrier layer comprises any of the group consisting of titanium oxide, alumina and bismuth silicate.

4. (Original) The semiconductor device according to claim 1:

wherein the diffusion barrier film is a film comprising any of or laminated with any of the group consisting of Ti, Ta, TiN, $\text{Al}_x\text{Ti}_{1-x}\text{N}$ and WN.

5. – 6. (Cancelled)

7. (Previously Presented) A semiconductor device comprising:

a substrate provided with a transistor;

an insulating film formed on the substrate and having an opening portion;

a conductive film formed in the opening portion; and

a capacitor formed on the conductive film and comprising a first electrode; a ferroelectrics film and a second electrode;

wherein the ferroelectric film includes at least one element selected from the group consisting of lead, barium and bismuth and formed on an upper face and side faces of the first electrode and on the insulating film;

wherein a reaction barrier film is provided between the insulating film and the ferroelectric film to prevent a reaction between the insulating film and the ferroelectric film, said reaction barrier film being in contact with a lower surface of said first electrode such that the reaction barrier film is interposed between the lower surface of the first electrode and said insulating film;

wherein a diffusion barrier film is provided between the conductive film and the first electrode and in the opening portion of the reaction barrier film; and

wherein an upper surface of said diffusion barrier film and an upper surface of said reaction barrier film are substantially on a same plane and thicknesses of said diffusion barrier film and said reaction barrier film are substantially the same.

8. (Original) The semiconductor device according to claim 7:

wherein side faces of the diffusion barrier film are not brought into contact with the ferroelectric film.

9. (Original) The semiconductor device according to claim 7:

wherein the ferroelectric film comprises any of the group consisting of lead titanate zirconate, lead titanate, barium lead titanate zirconate, barium lead niobate, strontium bismuth tantalite, bismuth titanate and barium strontium titanate zirconate.

10. (Original) The semiconductor device according to claim 7:

wherein the reaction barrier layer comprises any of the group consisting of titanium oxide, alumina and bismuth silicate.

11. (Original) The semiconductor device according to claim 7:

wherein the diffusion barrier film is a film comprising any of or laminated with any of the group consisting of Ti, Ta, TiN, $\text{Al}_x\text{Ti}_{1-x}\text{N}$ and WN.

12. – 29. (Cancelled)

30. (Previously Presented) A semiconductor device comprising:

an insulating film formed on a substrate provided with a transistor and having an opening portion;

a conductive film formed in the opening portion;

a capacitor formed on the conductive film and comprising a first electrode, a ferroelectric film and a second electrode, wherein the ferroelectric film includes at least one element selected from the group consisting of lead, barium and bismuth and formed from above the first electrode to above the insulating film; and

means for preventing a reaction between the insulating film and the ferroelectric film, said means for preventing a reaction being in contact with a lower surface of said first electrode such that the means for preventing a reaction is interposed between the lower surface of the first electrode and said insulating film;

wherein a diffusion barrier film is provided between the conductive film and the first electrode and side faces of the diffusion barrier are not brought into contact with the ferroelectric film;

wherein an upper surface of said diffusion barrier film and an upper surface of said means for preventing a reaction are substantially on a same plane and thicknesses of said diffusion barrier film and said means for preventing a reaction are substantially the same; and

wherein side faces of the first electrode are provided to be brought into contact with the ferroelectric film.

31. (Previously Presented) A semiconductor device according to claim 30, wherein said means for preventing a reaction comprises a TiO_2 film.

32. (Previously Presented) A semiconductor device comprising:

a substrate provided with a transistor;

an insulating film formed on the substrate and having an opening portion;

a conductive film formed in the opening portion,

a capacitor formed on the conductive film and comprising a first electrode; a ferroelectric film and a second electrode, wherein the ferroelectric film includes at least one element selected from the group consisting of lead, barium and bismuth

and formed on an upper face and side faces of the first electrode and on the insulating film; and

means for preventing a reaction between the insulating film and the ferroelectric film, said means for preventing a reaction being in contact with a lower surface of said first electrode such that the means for preventing a reaction is interposed between the lower surface of the first electrode and said insulating film;

wherein a diffusion barrier film is provided between the conductive film and the first electrode and in the opening portion of the means for preventing a reaction; and

wherein an upper surface of said diffusion barrier film and an upper surface of said means for preventing a reaction are substantially on a same plane and thicknesses of said diffusion barrier film and said means for preventing a reaction are substantially the same.

33. (Previously Presented) A semiconductor device according to claim 32, wherein said means for preventing a reaction comprises a TiO_2 film.

34. (New) A semiconductor device comprising:

an insulating film formed on a substrate provided with a transistor and having an open portion which has a wider area at an upper portion thereof and a narrow area at a lower portion thereof;

a tapered conductive film formed in the opening portion to have a wide area at a surface adjacent the upper portion of the opening portion and a narrow area adjacent the lower portion of the opening portion; and

a capacitor formed on the conductive film and comprising a first electrode, a ferroelectric film and a second electrode;

wherein the ferroelectric film includes at least one element selected from the group consisting of lead, barium and bismuth and formed from above the first electrode to above the insulating film;

wherein a reaction barrier film is provided between the insulating film and the ferroelectric film, said reaction barrier film being in contact with a lower surface of the first electrode such that the reaction barrier film is interposed between the lower surface of the first electrode and said insulating film;

wherein a diffusion barrier film is provided between the conductive film and the first electrode and side faces of the diffusion barrier are not brought into contact with the ferroelectric film;

wherein a distance from a first electrode edge to a diffusion barrier edge is larger than the width of a word line coupled to said transistor;

wherein an upper surface of said diffusion barrier film and an upper surface of said reaction barrier film are substantially on a same plane; and

wherein side faces of the first electrode are provided to be brought into contact with the ferroelectric film.

35. (New) The semiconductor device according to claim 34,

wherein the ferroelectric film comprises any of the group consisting of lead titanate zirconate, lead titanate, barium lead titanate zirconate, barium lead niobate, strontium bismuth tantalite, bismuth titanate and barium strontium titanate zirconate.

36. (New) The semiconductor device according to claim 34,
wherein the reaction barrier layer comprises any of the group consisting of titanium oxide, alumina and bismuth silicate.

37. (New) The semiconductor device according to claim 34,
wherein the diffusion barrier film is a film comprising any of or laminated with any of the group consisting of Ti, Ta, TiN, Al_xTi_{1-x}N and WN.

38. (New) A semiconductor device comprising:
a substrate provided with a transistor;
an insulating film formed on the substrate and having an opening portion which has a wider area at an upper portion thereof and a narrow area of a lower portion thereof;

a tapered conductive film formed in the opening portion to have a wide area at a surface adjacent the upper portion of the opening portion and a narrow area adjacent the lower portion of the opening portion; and

a capacitor formed on the conductive film and comprising a first electrode, a ferroelectric film and a second electrode;

wherein the ferroelectric film includes at least one element selected from the group consisting of lead, barium and bismuth and formed on an upper face and side faces of the first electrode and on the insulating film;

wherein a reaction barrier film is provided between the insulating film and the ferroelectric film said reaction barrier film being in contact with a lower surface of

said first electrode such that the reaction barrier film is interposed between the lower surface of the first electrode and said insulating film;

wherein a diffusion barrier film is provided between the conductive film and the first electrode and in the opening portion of the reaction barrier film;

wherein a distance from a first electrode edge to a diffusion barrier edge is larger than the width of a word line coupled to said transistor; and

wherein an upper surface of said diffusion barrier film and an upper surface of said reaction barrier film are substantially on a same plane.

39. (New) The semiconductor device according to claim 38,
wherein side faces of the diffusion barrier film are not brought into contact with the ferroelectric film.

40. (New) The semiconductor device according to claim 38,
wherein the ferroelectric film comprises any of the group consisting of lead titanate zirconate, lead titanate, barium lead titanate zirconate, barium lead niobate, strontium bismuth tantalite, bismuth titanate and barium strontium titanate zirconate.

41. (New) The semiconductor device according to claim 38,
wherein the reaction barrier layer comprises any of the group consisting of titanium oxide, alumina and bismuth silicate.

42. (New) The semiconductor device according to claim 38,
wherein the diffusion barrier film is a film comprising any of or laminated with
any of the group consisting of Ti, Ta, TiN, $\text{Al}_x\text{Ti}_{1-x}\text{N}$ and WN.

43. (New) A semiconductor device comprising:
an insulating film formed on a substrate provided with a transistor and having
an opening portion which has a wider area at an upper portion thereof and a narrow
area of a lower portion thereof;

a tapered conductive film formed in the opening portion to have a wide area at
a surface adjacent the upper portion of the opening portion and a narrow area
adjacent the lower portion of the opening portion;

a capacitor formed on the conductive film and comprising a first electrode, a
ferroelectric film and a second electrode,

wherein the ferroelectric film includes at least one element selected from the
group consisting of lead, barium and bismuth and formed from above the first
electrode to above the insulating film; and

means for preventing a reaction between the insulating film and the
ferroelectric film,

said means for preventing a reaction is in contact with a lower surface of said
first electrode such that the means for preventing a reaction is interposed between
the lower surface of the first electrode and said insulating film;

wherein a diffusion barrier film is provided between the conductive film and
the first electrode and side faces of the diffusion barrier are not brought into contact
with the ferroelectric film;

wherein a distance from a first electrode edge to a diffusion barrier edge is larger than the width of a word line coupled to said transistor;

wherein an upper surface of said diffusion barrier film and an upper surface of said means for preventing a reaction are substantially on a same plane; and

wherein side faces of the first electrode are provided to be brought into contact with the ferroelectric film.

44. (New) A semiconductor device according to claim 43,
wherein said means for preventing a reaction comprises a TiO₂ film.

45. (New) A semiconductor device comprising:
a substrate provided with a transistor;
an insulating film formed on the substrate and having an opening portion which has a wider area of an upper portion thereof and a narrow area of a lower portion thereof;

a tapered conductive film formed in the opening portion to have a wide area at a surface adjacent the upper portion of the opening portion and a narrow area adjacent the lower portion of the opening portion;

a capacitor formed on the conductive film and comprising a first electrode, a ferroelectric film and a second electrode, wherein the ferroelectric film includes at least one element selected from the group consisting of lead, barium and bismuth and formed on an upper face and side faces of the first electrode and on the insulating film; and

means for preventing a reaction between the insulating film and the ferroelectric film,

wherein said means for preventing a reaction is in contact with a lower surface of said first electrode such that the means for preventing a reaction is interposed between the lower surface of the first electrode and said insulating film;

wherein a diffusion barrier film is provided between the conductive film and the first electrode and in the opening portion of the means for preventing a reaction;

wherein a distance from a first electrode edge to a diffusion barrier edge is larger than a width of a word line coupled to said transistor; and

wherein an upper surface of said diffusion barrier film and an upper surface of said means for preventing a reaction are substantially on a same plane.

46. (New) A semiconductor device according to claim 45,

wherein said means for preventing a reaction comprises a TiO₂ film.